

# THE REVIEW

DEVOTED TO THE INTERESTS OF THE AMERICAN SOCIETY FOR METALS

Volume XIV

APRIL, 1941

No. 4

## PLANS FOR LOS ANGELES SHOW ANNOUNCED

### New Type of Carbide for Fast Machining

Reported by Jack I. Medoff

Physical Metallurgist, Worthington Pump Co.

New York Chapter—The lecture on "Sintered Carbides" by Philip McKenna, president, McKenna Metals Co., on March 10, once again presented the Chapter in the role of host to the powder metallurgists of the Metropolitan area (and many they were!).

The first development in carbide tools was the straight cemented tungsten carbide, which was excellent for machining cast iron but not so good for steel.

Various compositions, in the past 15 years, served to prevent galling, but for heavier cuts a stronger and non-cratering material was needed.

After about 5,000 experiments, the method was developed of forming the compound  $WTiC_2$ , as described by Mr. McKenna in METAL PROGRESS, August 1939, page 152.

Thus we have available a material of high hardness and low thermal conductivity capable of machining steel up to 550 Brinell hardness at high surface speeds. This has found ready application, especially in the aircraft field.

One of the problems resulting from the production demands on high speed cutting is the prompt removal of the chips and turnings. Use of chip breakers removes the danger to workers.

Comparing the role of tungsten in  
(Continued on page 4)

### N.W. Pa. Has Guests At President's Night

Reported by George S. DeArment

Asst. Plant Mgr., Champion DeArment Tool Co.

Northwestern Pennsylvania Chapter—National President's Night was held at the Lafayette Hotel in Meadville, Pa. on March 13.

Guests of the evening and at dinner were National President Oscar E. Harder, Assistant National Secretary Ray Bayless, Dr. I. A. Smith; C. W. Lindquist and G. E. Mohnhem of Oil Well Supply Co., C. T. Allen, L. W. McConnell, Ivan C. Marsteller, and George M. Barnes, all of Talon, Inc.

Vice-chairman Evans announced that Harold Wylie had moved to Bridgeport, Conn. and his duties as chairman of the Chapter were to be assumed by himself and Harvey Hays.

Assistant National Secretary Ray T. Bayless, was called upon to say a few words. He gave some details on the Western Metal Show and the coming Congress in Philadelphia, and stressed the important part the society is playing in the national defense program.

Vice-chairman Evans next introduced Dr. I. A. Smith, Meadville dentist, who exhibited color pictures taken on a cruise to South America.

Dr. Harder, the speaker for the evening, was introduced by J. H. Lencarts, superintendent of engineering at Talon, Inc., who was technical chairman. His subject was "Practical Aspects of Physical Metallurgy".

### Biltmore Hotel Made Official Headquarters



The Biltmore Hotel, Los Angeles, Headquarters for the Western Metal Congress to Be Held May 19 to 23. Morning technical sessions of the American Society for Metals and all meetings of the American Welding Society and American Foundrymen's Association will be held here.

### Western Metal Congress to Be Held May 19-23

Some of the finest minds of the metal industry will deliver lectures on the technical sessions of the Western Metal Congress, while some of the newest developments in metals, machines and equipment will be shown at the accompanying Western Metal Exposition.

The Congress will be held under the auspices of the American Society for Metals, with the American Welding Society, American Foundrymen's Association and other cooperating societies, May 19 to 23 in the Pan-Pacific Auditorium and the Biltmore Hotel, Los Angeles.

An unusual treatment of topics is promised in that many of the speakers will deliver a series of lectures on a certain topic. These will be of vast importance to the war industries—aviation, ships, and armament.

The theme of the meet will be to reduce costs, increase speed and produce a finer product, and the 150 firms covering 80,000 sq.ft. of exhibit space at the Pan-Pacific Auditorium will build their displays on the idea of "new aids to production".

Morning, afternoon and evening sessions of the American Society for Metals will be held on all five days of the Congress, as indicated in the complete program printed on pages 3 and 5.

The Metal Exposition at the Auditorium will be open every day from 12 noon until 10:30 p.m. except Thursday, when it will close at 6:00 p.m. Tech-  
(Continued on page 3)



### Compliments

To Charles Edgar Hoyt, executive vice-president and manager of exhibits of the American Foundrymen's Association, on the award of the Association's Joseph S. Seaman Medal.

To Donald J. Reese, engineer, Research & Development Division, International Nickel Co., New York, on the award of the J. H. Whiting Medal of the American Foundrymen's Association.

To Fred L. Wolf, technical director, Ohio Brass Co., Mansfield, Ohio, on the award of the John A. Penton Medal of the A.F.A.

To A.S.M. Past President Zay Jeffries, consulting engineer, lamp department, General Electric Co., Cleveland, on his appointment as chairman of a special committee of the National Academy of Sciences asked by the Office of Production Management to investigate substitutes for vital defense metals. William H. Eisenman, national secretary A.S.M., is secretary of the Committee.

To Alexander H. d'Arcambal, consulting metallurgical engineer, Pratt & Whitney Co., Hartford, and to James H. Herron, president of James H. Herron Co., Cleveland, on citations for distinguished service received at the Engineering Alumni Conference of the University of Michigan.

To Cincinnati Chapter Chairman M. H. Brumble for his skill at the sport of archery. (See Past Chairman Kurt Siems for details.)

### Practical Points Given on Tools for Shell Forging

Reported by R. S. Crowder

Observer, Tenn. Coal, Iron & R.R. Co.

Southern Chapter—Some 200 members and associates had a most pleasant and instructive session, led by H. J. Stagg, metallurgist for Crucible Steel Co. of America, in March. Mr. Stagg's subject was "Tool Steel's Part in National Defense".

The speaker covered especially those tool steels used in shell forging and the shell forging processes in this country and Canada. His discussion of these tool problems held to the practical side and was a real aid to those actually engaged in this work.

He also showed Crucible's excellent color film of the manufacture of tool steels including some wonderful shots of the crucible process.

### Local Talent Contributes To Rocky Mtn. Course

Reported by E. J. McKnight

Time-keeper, Griffin Wheel Co.

The educational lectures given by members of Rocky Mountain Group are drawing to a close, and a review of the past six months brings to mind a number of persons who contributed greatly to the success of this program, namely:

Floyd Anderson of Gardner-Denver Co.; Wayne Parcel and Paul Archibald of the "Rio Grande"; George Kincaid of Magnus Metal Co.; Telfer Norman of Climax Molybdenum Co.

John E. Holtman of American Manganese Steel Co. and Curtis Drake of Griffin Wheel Co., also contributed by the donation of an auditorium and by the digging up of talent, respectively.

The course covered fundamentals of metallurgy, metallography, and testing, and more advanced subjects.

### "Saving the Surface" Covers Various Hardening Methods

Reported by Walter M. Saunders, Jr.  
Consulting Chemist and Metallurgist

Rhode Island Chapter—Carl F. Floe, assistant professor of physical metallurgy at M.I.T., could have chosen as the title of his talk at the Feb. 5th meeting, "Save the Surface, and You Save All". Instead he decided on a more conservative and descriptive one, namely "Surface Hardening of Steels."

Under this general subject he grouped carburizing, cyaniding, nitriding, chromizing, siliconizing, and induction and flame treatments.

The type of material used and the advantages and limitations of each method were discussed in considerable detail. Even the experts in any particular field could not help but benefit from the excellent summary presented by Dr. Floe.

The golfers in the Chapter who attended the dinner preceding the meeting heard Dr. S. I. Strickhouser, U. S. Rubber Co., knock out one of their favorite alibis for high scores. A movie showing the making and testing of golf balls convincingly demonstrated that inability to beat old man Par is not necessarily due to the ball, and never is when U. S. Royals are used.

# THE REVIEW

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RAY T. BAYLESS.....*Editor*  
M. R. HYSLOP.....*Managing Editor*

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## Univ. Students Are Lecturers at Special Cincinnati Meeting

Reported by K. Siems

Sales Engineer, Cincinnati Milling Machine Co.

Cincinnati Chapter—A newly estab-  
lished custom of holding at least one  
meeting a year at University of Cin-  
cinnati was repeated on March 20.

J. F. Kahles, instructor in metallurgy  
in the Chemical Engineering Depart-  
ment of the University and a member  
of the Chapter, acted as toastmaster.

Lectures were presented by two stu-  
dents, Earle R. Saunders, candidate for  
Ph.D., whose subject was "A Study of  
Martensite Formation", and Herbert L.  
Eiselstein, undergraduate, who spoke  
on "Studies in Recrystallization and  
Grain Growth". These two men had  
been selected by Prof. R. O. McDuffie  
for their outstanding qualities in their  
particular lines of study.

Mr. Saunders presented a general  
study of the austenite-to-martensite re-  
action, and a review of the previous in-  
vestigations. The present situation  
was discussed first according to the  
"S" curve theory, and then according  
to that of Carpenter and Robertson.

A metallographic method similar to  
that used by Greninger and Troiano  
was described in detail, and a series of  
slides illustrated the transformation in  
eutectoid steels at two isotherms. The  
possibility was shown of the application  
of photometric analysis to the evalua-  
tion of the per cent of martensite in  
each sample.

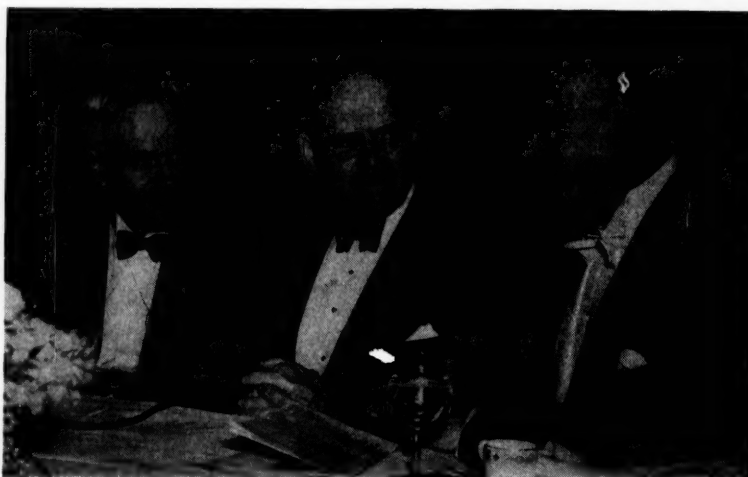
Mr. Eiselstein gave a brief review of  
recrystallization and grain growth.  
Evidence was cited to show that grain  
growth is a phenomenon that is to be  
expected from considerations of surface  
energy, greater solubilities of very fine  
particles, and greater vapor pressures  
of small particles.

Mehl and Johnson's equation for the  
fraction of material transformed as a  
function of time was critically analyzed  
from the standpoint of its application  
to recrystallization. Slides showing  
various degrees of partial recrystalliza-  
tion were shown to illustrate this part  
of the lecture.

Nucleation in the recrystallization of  
silicon iron was shown to be of the  
grain boundary type.

Evidence was presented to show that  
at least in some instances, a plot of the  
logarithm of the number of grains per  
unit area against the reciprocal of the  
annealing time will yield a straight  
line except for short annealing times  
at low temperatures.

## Washington Has Burgess Memorial Night



Speaker Paul D. Merica, Toastmaster W. M. Corse and National  
President Oscar E. Harder Talk It Over Between Courses at Banquet

## "Six Honest Metal Men" Do the Honors For Kipling at N.J. "Information Pleases"

Reported by Fred P. Peters  
Assistant Editor, Metals and Alloys

"I keep six honest serving men  
They taught me all I knew.  
Their names are What and Why and  
When  
And How and Where and Who."

New Jersey Chapter—When he  
penned these lines, Kipling was obvi-  
ously forecasting the Feb. 17th meeting  
—an "Information Pleases" session  
with six honest metal men doing the  
honors for What, Why, When, etc.

These six gallant gentlemen were  
G. H. Bierman, American Can Co., T. L.  
Counihan, Hyatt Bearings Div., General  
Motors Corp., F. La Que, International  
Nickel Co., P. Payson, Crucible Steel  
Co., G. M. Rollason, Aluminum Co. of  
America and S. Skowronski, Interna-  
tional Smelting & Refining Co.

The "technical director" (euphemism  
for official heckler) was R. J. Allen of  
Worthington Pump & Machinery Corp.  
Mr. Allen was aided in his efforts by  
three referee "judges" and by a prop-  
erly discreet warning-bell.

During the first half of the meeting  
the experts answered about 20 ques-  
tions, mostly straightforward requests  
for information, that they had had an  
opportunity to study; then, in the sec-  
ond half, the six sufferers faced a bar-  
rage of impromptu questions.

The straight-information questions  
included not only direct inquiries as to  
the nature of certain products or  
processes, such as Calorizing, sterling  
silver, Alclad and "K" Monel, but also

calls for help in remedying such condi-  
tions as temper brittleness in alloy  
steels, vibration-failures in mechanical  
parts, corrosion of steam chambers, sur-  
face checks or fractures in gunmetal,  
and grinding cracks in high chromium  
tool steels.

The "stumper" questions provided not  
only entertainment for all but cash  
(\$1 each) for questioners who tripped  
the experts and for experts who out-  
witted their persecutors.

There were some split decisions from  
which both sides profited, but even in-  
cluding these, only five of the Chapter's  
hard-earned dollar bills were garnered  
by the audience after 25 questions had  
been asked.

Readers may be interested in ponder-  
ing the somewhat irrelevant final ques-  
tion—"What is the difference in chemi-  
cal composition between water on the  
inside and on the outside of a fire  
hydrant?"—but are requested not to  
send their answers, particularly if cor-  
rect, to this paper.

## Rapid Increase in Uses Of Copper and Number of Its Alloying Elements Seen

Reported by D. M. Horner  
Harrisburg Steel Corporation

York Chapter's meeting on Feb. 12  
was featured by a non-ferrous talk on  
"Copper and Its Alloys—Their De-  
velopment and Uses" by B. H. McGar,  
assistant director of research for the  
Chase Brass and Copper Co.

The uses of copper have increased  
until today they are universal, basically  
because the metal is easily fabricated  
and possesses excellent thermal and  
electrical conductivity.

The number of other elements alloyed  
with copper has increased tremendously  
in recent years, so that today there are  
a great many different compositions  
made to enhance one or more of the  
physical properties of the base metal.  
Even aluminum and antimony, which  
once were regarded as poison to copper,  
are now used in some copper alloys.

Mr. McGar reviewed the various  
methods of refining and fabricating  
copper. Hardening copper by cold  
work or by alloying it with phosphorus,  
tin, iron, zinc, silicon, beryllium, or  
arsenic was discussed, as were also the  
general classifications of brasses.

Many special alloys are used for  
their free machinability, high tensile  
strength—up to 193,000 psi.—and the  
excellent combination of good forge-  
ability with good machinability.

## Metallurgy of Alloys Topic of Merica's Talk

Reported by J. G. Thompson

Principal Metallurgist, National Bureau of  
Standards

Washington Chapter—The first Bur-  
gess Memorial Night, held Monday,  
Feb. 10, was a memorable occasion for  
274 members and guests. This event  
has been established to honor George  
Kimball Burgess, a founder of the  
Chapter, who has contributed much to  
the science of physical metallurgy.

Miss Clara Burgess, of Boston, Mass.,  
sister of the late Dr. Burgess, was a  
guest of honor. Several former asso-  
ciates of Dr. Burgess were included  
among the many distinguished guests  
who came to Washington for the eve-  
ning.

Seated at the speaker's table with  
Toastmaster W. M. Corse and C. E.  
Jackson, who acted as chairman in the  
absence of G. A. Ellinger, were Paul  
D. Merica, first Burgess Memorial Lec-  
turer; A. S. M. President O. E. Harder,  
L. J. Briggs, G. E. F. Lundell, Col. G.  
F. Jenks, H. S. Rawdon, G. H. Clamer,  
F. B. Olcott, and J. J. Crowe.

## Tributes Paid to Burgess

The evening opened with a eulogy  
of Dr. Burgess by President Harder.  
Then F. B. Olcott presented a bio-  
graphical sketch of Dr. Burgess's  
achievements and of the honors be-  
stowed upon him.

After a musical interlude by Mrs. H.  
K. Herschman, Dr. Merica paid a per-  
sonal tribute to Dr. Burgess and then  
delivered the first Burgess Memorial  
Lecture, "Progress in Alloy Metal-  
lurgy".

The speaker covered the past achieve-  
ments in the preparation and fabrica-  
tion of alloys, current developments,  
and possibilities for the future in such  
a delightful and comprehensive man-  
ner that an attempt to abstract the  
lecture would be fruitless. Arrange-  
ments are being made for its publica-  
tion in METAL PROGRESS.

At the close of the lecture, Col. G.  
F. Jenks, on behalf of the Chapter, pre-  
sented Dr. Merica with a certificate  
which conferred upon him the distinc-  
tion of being the first Burgess Mem-  
orial Lecturer, thus bringing to a close  
an evening which is outstanding in the  
history of the Washington Chapter.

Credit for the complete success of  
the meeting goes to the Committee on  
Arrangements, under the able chair-  
manship of H. K. Herschman.

## Grain Size Is Example of Application of Lab Test

Reported by R. W. Weld

Service Engineer, Claud S. Gordon Co.

Indianapolis Chapter—Following the  
practice of having one lecture each  
year on the practical application of  
some metallurgical laboratory pro-  
cedure or test method, A. E. Focke, re-  
search metallurgist, Diamond Chain  
and Mfg. Co., Indianapolis, discussed  
the subject of "Grain Size" for the  
March meeting.

Dr. Focke gave the background of  
grain size study, including the various  
methods and advantages of measuring  
grain size, conditions of grain growth  
and inhibitors. He also discussed the  
effect and manipulation of grain size,  
going quite thoroughly into the effect  
of austenitic grain size on the physical  
properties of steel.

Particularly the speaker stressed the  
limitations of the concept of inherent  
grain size and centered his discussion  
around tests which he had made.

## Mahoning Valley Sponsors Two Sunday Broadcasts

Reported by D. J. Curtin

Metallurgist, Youngstown Sheet and Tube Co.

Mahoning Valley Chapter—On March  
11, Richard Kropf, metallurgist for  
Copperweld Steel Co., spoke on "Serv-  
ice Failures in Alloy Steels". Despite  
the inclement weather a large crowd  
was present and enthusiastically re-  
ceived Mr. Kropf's paper.

On Sunday, March 9, the Chapter  
presented over Radio Station WKBN,  
Youngstown, a 15-min. interview on the  
topic "Progress in Metals during 1940".  
A. A. Chambers, chief metallurgist,  
Youngstown Sheet and Tube Company,  
was the speaker.

Another interview was presented on  
Sunday, March 16, on "Strategic  
Metals in U. S. Defense". L. D. Wood-  
worth, chief metallurgist, Carnegie-Illi-  
nois Steel Corp., Youngstown, was the  
speaker.



# A.S.M. Time Table Program, Western Metal Congress

|                     | Biltmore<br>9-9:55 a.m.     | Biltmore<br>10-10:55 a.m. | Biltmore<br>11-12 a.m.               | Pan-Pacific<br>2:30-3:25 p.m.  | Pan-Pacific<br>3:30-4:30 p.m. | Pan-Pacific<br>7:30-8:25 p.m. | Pan-Pacific<br>8:30-9:30 p.m. |
|---------------------|-----------------------------|---------------------------|--------------------------------------|--------------------------------|-------------------------------|-------------------------------|-------------------------------|
| Monday<br>May 19    | Van Horn<br>Aluminum        | French<br>Alloy Steels    | McQuaid<br>Carbon Steels             | Grossmann<br>Heat Treatment    | McQuaid<br>Oil Industry       | Thum<br>Inspection            | Krivobok<br>Stainless         |
| Tuesday<br>May 20   | Van Horn<br>Aluminum        | French<br>Alloy Steels    | Van Horn<br>Stresses in Al           | Grossmann<br>Heat Treatment    | Hildorf<br>Oil Industry       | Thum<br>Inspection            | Krivobok<br>Stainless         |
| Wednesday<br>May 21 | Van Horn<br>Aluminum        | French<br>Alloy Steels    | Stoughton<br>High Temperature        | Grossmann<br>Heat Treatment    | Gill<br>Machinability         | Thum<br>Inspection            | Krivobok<br>Stainless         |
| Thursday<br>May 22  | Winston<br>Magnesium Alloys | French<br>Alloy Steels    | Triplett-Danford<br>X-Ray Inspection | Grossmann<br>Heat Treatment    | Gill<br>Machinability         | Banquet<br>(Biltmore)         | Banquet<br>(Biltmore)         |
| Friday<br>May 23    | Winston<br>Magnesium Alloys | Harder<br>Bearing Metals  | Triplett-Danford<br>X-Ray Inspection | Bowden<br>Role of Metallurgist | Gill<br>Machinability         | Thum<br>Inspection            | Krivobok<br>Stainless         |

## Welding Society And A.F.A. in Western Show

(Continued from page 1)

nical sessions will also be suspended Thursday evening in order to allow those at the Congress to attend the dinner dance being given by the American Society for Metals.

The American Welding Society will hold technical sessions Monday through Thursday, May 19 through 22, with the annual regional luncheon on Monday noon at the Biltmore Hotel.

Foundry Day will be observed Friday, May 23, by the American Foundrymen's Association, with some of its sessions being held on Thursday. Complete programs of the A.W.S. and A.F.A. are found on page 5.

A complete list of exhibitors at the Western Metal Exposition is given on page 7. As in past years a special section has been set aside for the Gas Exhibit. This is in charge of E. M. de Remer and Frank Weiss of the Southern California Gas Co. and C. L. Ferry of Southern Counties Gas Co.

### Cooperating Societies

Western sections of the 19 national technical societies cooperating in the Congress and Exposition are:

American Ceramic Society, American Chemical Society, American Foundrymen's Association, American Institute of Electrical Engineers, American Institute of Mining and Metallurgical Engineers, American Petroleum Institute, American Society of Civil Engineers, American Society for Testing Materials, American Welding Society.

California Gas and Oil Association, Institute of Aeronautical Sciences, Liquefied Petroleum Gas Association, Metal Trades and Manufacturers' Association, Mining Association of the Southwest, National Purchasing Agents' Association, Pacific Coast Electrical Association, Pacific Coast Gas Association, Society of Automotive Engineers, Wire Association.

### Committee Heads

The Western Metal Congress General Committee headed by A. G. Zima, western representative, International Nickel Co., follows:

B. H. Brown, metallurgist, Bethlehem Steel Co., general vice-chairman.

W. J. Parsons, Pacific Scientific Co., general secretary.

W. W. Farrar, president, Farrar Industrial Products Co., exhibit chairman. C. E. Burt, chief engineer, Baker Oil Tools, Inc., and James H. Knapp, president, James H. Knapp Co., exhibit vice-chairmen.

D. S. Clark, associate professor of mechanical engineering, California Institute of Technology, program chairman. G. A. Gallagher, engineering instructor, Los Angeles Junior College, program vice-chairman.

W. A. de Ridder, president, General Metals Corp., publicity chairman.

J. E. Wilson, metallurgist, Climax

## Crowds Shown at 1938 Exposition on Coast



The Western Metal Exposition, Which in 1938 Attracted More Than 36,000 Fabricators and Users of Metal, Will Be Held Again May 19 to 23 in the Pan-Pacific Auditorium, Los Angeles. The photograph shows a section of the crowd which in one night in 1938 jammed into the Metal Show. Expectations are that attendance this year will exceed 50,000.

Molybdenum Co., information and registration chairman.

H. R. Abey, district manager, Leeds and Northrup Co., attendance chairman.

Harold Etter, district manager, Air Reduction Sales Co., entertainment chairman.

P. D. McElfish, Standard Oil Co. of California, chairman of cooperating committee of technical societies.

## Powder Metallurgy Talk Covers Origin of WC

Reported by C. A. Nagler

Instructor, University of Minnesota

North West Chapter—Professor Gregory J. Comstock of Stevens Institute of Technology, Hoboken, N. J., was the speaker at the March meeting, held in the spacious men's lounge of the Coffman Memorial Union on the Campus of the University of Minnesota.

His talk on "Powder Metallurgy" is reported in another column.

The speaker devoted some time to a description of the work done under Dr. Strauss at the Krupp Works in Germany, prior to World War I, in the production of tungsten carbide. The tungsten which sold originally for \$450 per pound has been reduced in price over a period of years.

The remainder of the evening was spent in a description of the production of Alconite, bearing metals, complex cutting carbide tools and permanent magnets. The talk was illustrated with a goodly number of slides, and was followed by a general discussion of definite applications of powder metallurgy.

## Chapter Told Soviet Has Long Way to Go

Worcester Chapter—Soviet Russia can become one of the leading powers of the world but "has a long way to go yet", according to Charles W. Hawthorne of Conneautville, Pa., erecting engineer, who spoke on Feb. 5.

He described experiences of 16 months spent in Russia in 1939 and 1940 while supervising construction of a steel rod mill in Makeevka, city of 250,000 in the Ukrainian Republic.

Chief basis cited by the speaker for Russia's potentialities as a world power is its vast fund of natural resources.

Main obstacle, on the other hand, to the U. S. S. R.'s advance to such a position, according to Mr. Hawthorne, is the average Russian's "absolute indifference to government and to the modern tempo of life".

The speaker listed education and collective farming as fields of endeavor in which Russia has made greatest advances since 1917, with a reported 80% increase in literacy and a bumper 1940 crop that has served in large measure to put the nation into a strategic position in the current international lineup of countries.

His points were illustrated with many amusing anecdotes of life as the only English-speaking person in a large Ukrainian industrial center.

An additional feature of the dinner meeting was showing of a motion picture, "Making and Shaping of Steel", taken in plants of the United States Steel Corp.

## Beryllium Used In Alloys With Cu, Ni and Al

Reported by J. W. Poynter

Asst. Met., Army Air Corps, Wright Field

Dayton Chapter—A subject new to most of the audience was discussed at the March technical meeting, when Charles B. Sawyer, president of the Brush Beryllium Co., Cleveland, spoke on "Beryllium and its Alloys".

The chemical element beryllium was discovered in 1797 and isolated in 1828. Beryllium-copper alloys were first made in 1897 but were not offered commercially until 1932.

No concentration process is now in use for the separation of beryl, the beryllium ore, from feldspar. As a result, the beryl must be picked out by hand.

### Reduction of Ore

After gas preheating, the beryl is melted in a carbon lined electric furnace at 2900° F. When fused it is poured into water and then treated with sulphuric acid. Aluminum is separated as an alum by the addition of ammonia and the beryllium sulphate is then separated out.

The sulphate is converted into the oxide by heating at 1800 to 2600° F. The oxide is reduced with copper chips and carbon in an arc furnace at 3600° F. to produce the master beryllium-copper alloy (4 to 4.5% Be).

Two types of beryllium-copper alloys are used commercially, those with a high beryllium content (2.25%), and those with low beryllium (0.25%) and nickel, cobalt or chromium.

The high beryllium alloys have high strength and hardness (350 to 400 Brinell), good electrical conductivity, a low modulus of elasticity (18,000,000), and a high elastic limit. The low beryllium alloys must be heat treated in controlled atmospheres to prevent surface oxidation.

A nickel-base alloy containing 1.9% beryllium has developed a tensile strength of 260,000 psi., a Brinell hardness of 480, and 8% elongation. The hardness of a 1% beryllium, 6% nickel, remainder iron alloy is 600 Brinell.

### Use in Stainless Steel

Stainless steel of the 18-8 type can be made precipitation hardening by the addition of beryllium but the corrosion resistance is impaired.

A beryllium-aluminum alloy has had tensile strengths as high as 18,000 psi. at 600° F.

On Feb. 25, Chairman Faulkender, Vice-Chairman Carl, Secretary Rapp and Treasurer Prantz presented a popular broadcast on metallurgy over Radio Station WHIO.

On March 13, a joint meeting was held with the Dayton Branch of the National Association of Purchasing Agents to hear Raoul E. Desvernine, president of the Crucible Steel Co. of America, speak on the subject "Business Looks at National Defense".

## Problems of Railroad Design Are Stressed By Two Speakers

Reported by E. J. McKnight  
Time-Keeper, Griffin Wheel Co.

Rocky Mountain Group—Two fine speakers at the February meeting were O. J. Horger, director of railroad engineering and research of Timken Roller Bearing Co., who spoke on "Strength of Materials" and W. H. Sagstetter, chief mechanical officer of the Denver & Rio Grande Western Railroad, who spoke on "Thirty Years as a Supervisor".

The talks were particularly appropriate in view of the fact that this was a joint meeting with the American Society of Mechanical Engineers, Colorado Section.

Dr. Horger's discussion was confined to fatigue failures with particular emphasis on the weakness of press-fitted assemblies and means of improving their fatigue resistance.

"Increased speeds and loads on railroads have caused a great many more failures in the last few years than before," said Dr. Horger, "and the elimination of failures by the use of alloys and redesign of parts is the problem of today."

Photo-elastic studies give a good picture of what happens to materials under stress and indicate where redesign is necessary.

### Laboratory Eliminates Failures

Mr. Sagstetter's remarks dove-tailed with those of Dr. Horger in many places. "It was the practice" he said, "some years ago, on the 'Rio Grande', when a part failed repeatedly, to redesign the part, merely adding more weight, and in many cases the causes of the failures were not eliminated."

However, since the inception of the laboratory, at a cost of about \$160,000, there has been more progress in the elimination of failures than in the sixty years before, and the part played by the use of alloys cannot be overestimated.

"Also, by documenting each failure, attention is called to too frequent incidents and action taken to correct the condition."

Through the courtesy of Mark A. Skinner, superintendent of the United States Mint, Rocky Mountain Group was treated to a trip on Feb. 7 through the only institution in the Rocky Mountain region that makes money year in and year out, regardless of business conditions!

## Impact, Fatigue Tests Important In Air Engines

Reported by Jack I. Medoff

Physical Metallurgist, Worthington Pump Co.

New York Chapter—Speaking on "Aircraft Metallurgy" at the Jan. 13th meeting, R. R. Moore, chief metallurgist, Naval Aircraft Factory, Philadelphia, chose to confine himself to a discussion of the metallurgical considerations in aircraft engine construction, a subject representing a very wide application of materials.

Much of the problem involves satisfying the insistent demands for more power and longer life while reducing the weight per horsepower.

Since 1922, the weight per horsepower ratio has decreased from 2½ lb per h.p. to 1.1 lb. today, with 1 lb. to be expected shortly. (Incidentally, this decreasing weight-power ratio is due more to increasing power development than to a reduction in weight).

The speaker indicated a growing tendency to supersede the aluminum alloys with steel forgings, because of the strength when going over 1000 horsepower.

Margins of safety are kept down by the proper selection of materials and care in maintaining their best characteristics. Rigid inspection is required, since surface blemishes that would be insignificant in ordinary constructional work can assume major significance in airplane engines.

The value of impact and fatigue testing was stressed, failure often resulting from minor surface and sub-surface defects that may never be noticed in the usual tension tests. To minimize the possibility of fatigue failure, a smooth, high finish is specified for many surfaces.

An extremely interesting and important part of the talk was a collection of slides illustrating actual failures in a series of engine parts, and a running commentary by the speaker on the causes of failure which included tool marks, grinding cracks, sharp fillets, and inclusions.

A thorough discussion of the importance and use of the Magnaflux method of testing concluded the lecture, and was accompanied by slides showing the apparatus in operation at the speaker's plant and indicating methods for disclosing both horizontal and vertical defects.

In the lively discussion led by Tech-

## A.S.M. and A.S.T.E. Have Joint Meeting



At Meeting in Springfield are: BACK ROW, Left to Right—Executive Committee Member A. W. Morris; Frank W. Curtis, Chairman, Springfield Chapter, A.S.T.E.; Paul Farren, Chairman, Springfield Chapter, A.S.M.; FRONT ROW—A. J. Carruthers, Secretary, Springfield Chapter A.S.M.; Hans Ernst, Speaker of the Evening; Technical Chairman Rodney Ericson.

nical Chairman B. R. Queneau, Mr. Moore attributed 90% of failures encountered to improper design.

An appropriate after-dinner talk on "The Use of Plastics in Aircraft" was interestingly presented by Harry Carlson of the Bakelite Co.

He told of an important new development in "low-pressure molding" which permits the use of veneer presses, thus releasing to the defense industries the big equipment ordinarily needed.

### McQuaid Discusses Modern Metallurgy at Muncie

Muncie Chapter—Harry W. McQuaid, prominent metallurgist of the Republic Steel Corp., Cleveland, co-discoverer of the McQuaid-Ehn grain-size test, was the principal speaker at a dinner meeting at the New Castle, Ind., Y. M. C. A. in March.

Mr. McQuaid discussed modern trends in metallurgy and mentioned in particular the grain size of metals.

Approximately 50 metallurgists from Muncie, Anderson and Richmond attended the meeting.

The New Castle committee in charge of the dinner meeting was composed of Stanley Souders of the Chrysler Corp., N. B. Lance of the Public Service Co., J. J. Baum and Roy Atwater of the Ingersoll Steel and Disc Co.

Reported by Rodney L. Ericson

Metallurgist, American Saw & Mfg. Co.

Springfield Chapter—On Feb. 17, before a joint meeting with the American Society of Tool Engineers, Hans Ernst, director of research, Cincinnati Milling Machine Co., gave his lecture: "Metal Cutting, Friction and Finish".

A record-breaking crowd of over 500 turned out to hear this very timely paper.

It consisted of a review of Mr. Ernst's work, and correlated the paper which he presented (together with M. E. Merchant) before the National Metal Congress in October, 1940.

Mr. Ernst told of the findings of research engineers who have been probing friction as a cause of variations in finished products. It has been proven that friction at the point of tools is responsible in a large measure for some of the heretofore untraceable variations in metal finishing.

He also spoke on the effect of cutting fluids on chip formation and the resultant surface finish.

Mr. Ernst illustrated his talk with slides and color films.

### New Type of W Carbide Used for Fast Machining

(Continued from page 1)

use as carbide tools against its use as high speed steel (18-4-1), reports from Germany indicate that the "effectiveness ratio" is estimated to be 20 to 1, while the results of work at Westinghouse suggest a ratio of 60 to 1; i.e., 1 lb. of tungsten used as carbide tools does work equivalent to that done by 60 lb. of tungsten as high speed steel tools. This comparison readily assumes significance in view of the status of tungsten as a strategic material.

A vigorous discussion led by Technical Chairman Morgan Rogers of The Callite Tungsten Co. brought out many practical points of operation from the speaker and the audience.

In commenting on lubrication, Mr. McKenna claimed that the low coefficient of friction makes unnecessary the use of lubricants. However, in order to secure the advantages of the low coefficient of friction, the higher speeds must be used, as the coefficient seems to increase with decreasing speeds below a certain minimum value.

In any event, he warned against the use of sulphur-bearing oils as unhealthy for the cobalt and nickel in the tools.

## Grossmann Gives 2nd Lecture in St. Louis Heat Treating Course



George Moeller, Chairman of the Educational Committee, St. Louis Chapter, Introduces M. A. Grossmann, Director of Research, Carnegie-Illinois Steel Corp., at the Second Session of an Educational Course on "Heat Treatment of Steel". Dr. Grossmann's textbook on "Principles of Heat Treatment" is being used for the course. Enrollment is 150. Other lecturers in the course are V. X. Hohn of Scullin Steel Corp., C. B. Swander of Wagner Electric Corp., M. E. Meyerson, St. Louis Testing Laboratory, A. F. Mohri, Granite City Steel Co., and E. C. Bain, U. S. Steel Corp.



# Technical Papers Program, Western Metal Congress

## American Society for Metals

(Series of lectures are shown in italics; individual lectures in roman type.)

### Monday, May 19

9:00 a.m.—Biltmore Hotel

Aluminum—Kent R. Van Horn, Research Metallurgist, Aluminum Co. of America, Cleveland.

Alloy Steels—H. J. French, Research Metallurgist, International Nickel Co., New York.

MAKING THE MOST OF LOW CARBON AND ALLOY STEELS—H. W. McQuaid, Assistant Chief Metallurgist, Republic Steel Corp., Cleveland.

2:30 p.m.—Pan-Pacific Auditorium

Heat Treatment of Metals—M. A. Grossmann, Chief Metallurgist, Chicago District, Carnegie-Illinois Steel Corp.

FERROUS METALS USED IN THE OIL INDUSTRY—H. W. McQuaid, Assistant Chief Metallurgist, Republic Steel Corp., Cleveland.

7:30 p.m.—Pan-Pacific Auditorium

Inspection of Metals—E. E. Thum, Editor METAL PROGRESS, Cleveland.

Stainless Steels—V. N. Krivobok, Director of Structural Research, Lockheed Aircraft Corp., Burbank, Calif.

### Tuesday, May 20

9:00 a.m.—Biltmore Hotel

Aluminum—Kent R. Van Horn (2nd Lecture).

Alloy Steels—H. J. French (2nd Lecture).

THE INTERNAL STRESSES OF ALUMINUM ALLOY FORGINGS AND CASTINGS—Kent R. Van Horn, Research Metallurgist, Aluminum Co. of America, Cleveland.

2:30 p.m.—Pan-Pacific Auditorium

Heat Treatment of Metals—M. A. Grossmann (2nd Lecture).

METALS USED IN THE REFINERY PROCESS—Walter Hildorf, Chief Metallurgist, Timken Steel & Tube Div., Canton, Ohio.

7:30 p.m.—Pan-Pacific Auditorium

Inspection of Metals—E. E. Thum (2nd Lecture).

Stainless Steels—V. N. Krivobok (2nd Lecture).

### Wednesday, May 21

9:00 a.m.—Biltmore Hotel

Aluminum—Kent R. Van Horn (3rd Lecture).

Alloy Steels—H. J. French (3rd Lecture).

HOW METALS BEHAVE AT HIGH TEMPERATURE—Bradley Stoughton, Professor of Metallurgy, Lehigh University, Bethlehem, Pa.

2:30 p.m.—Pan-Pacific Auditorium

Heat Treatment of Metals—M. A. Grossmann (3rd Lecture).

Tool Steels and Machinability—James P. Gill, Chief Metallurgist, Vanadium-Alloys Steel Co., Latrobe, Pa.

7:30 p.m.—Pan-Pacific Auditorium

Inspection of Metals—E. E. Thum (3rd Lecture).

Stainless Steels—V. N. Krivobok (3rd Lecture).

### Thursday, May 22

9:00 a.m.—Biltmore Hotel

Magnesium Alloys—A. W. Winston, Metallurgist, Dow Chemical Co., Bay City, Mich.

Alloy Steels—H. J. French (4th Lecture).

Recent Developments in X-Ray Inspection of Aircraft Materials—Tom A. Triplett, President, and Vance P. Danford, Research Chemist, Triplett & Barton, Inc., Burbank, Calif.

2:30 p.m.—Pan-Pacific Auditorium

Heat Treatment of Metals—M. A. Grossmann (4th Lecture).

Tool Steels and Machinability—J. P. Gill (2nd Lecture).

7:30 p.m.—Biltmore Hotel

DINNER DANCE, A.S.M. and Cooperating Societies.

### Friday, May 23

9:00 a.m.—Biltmore Hotel

Magnesium Alloys—A. W. Winston (2nd Lecture).

PHYSICAL METALLURGY OF BEARING METALS—O. E. Harder, Assistant Director, Battelle Memorial Institute, Columbus, Ohio.

X-Ray Inspection of Aircraft Materials—Tom A. Triplett and Vance P. Danford (2nd Lecture).

2:30 p.m.—Pan-Pacific Auditorium

ROLE OF THE METALLURGIST IN PRODUCTION OF ALLOY STEELS—Ray Bowden, Manager, Metallurgical Division, Carnegie-Illinois Steel Corp., Chicago.

Tool Steels and Machinability—J. P. Gill (3rd Lecture).

7:30 p.m.—Pan-Pacific Auditorium

Inspection of Metals—E. E. Thum (4th Lecture).

Stainless Steels—V. N. Krivobok (4th Lecture).

## American Welding Society

(All technical sessions at the Biltmore Hotel, 9:00 a.m.)

### Monday, May 19

FLAME MACHINING—George F. Slottman, Manager, Applied Engineering Dept., Air Reduction Sales Co., New York.

ALL-WELDED SHIP CONSTRUCTION (Illustrated by Progress Motion Pictures)—L. W. Delhi, Manager, Western Pipe and Steel Co., San Francisco.

12:00 Noon—A.W.S. Luncheon

### Tuesday, May 20

RESISTANCE WELDING IN AIRCRAFT—F. A. Hurcomb, West Coast Engineering Representative, Taylor Winfield Corp., Warren, Ohio.

THE PROCEDURE OF SPOT WELDING OF ALUMINUM ALLOYS IN THE AIRCRAFT INDUSTRY—Charles L. Hibert, Foreman, Spot Welding and Heat Treating

Departments, Consolidated Aircraft Corp., San Diego, Calif.

WELDING OF STAINLESS STEELS—V. N. Krivobok, Director of Structural Research, Lockheed Aircraft Corp., Burbank, Calif.

### Wednesday, May 21

THE TRAINING OF WELDING OPERATORS—T. B. Jefferson, Editor *The Welding Engineer*, Chicago.

HIGH PRESSURE, HIGH TEMPERATURE PIPING—F. C. Fantz, Vice-President, Midwest Piping and Supply Co., St. Louis.

CODES—Russell Love, Engineer, Southwest Welding and Mfg. Co., Alhambra, Calif.

1:30 p.m.—Plant Visit

Midwest Piping and Supply Co., Los Angeles; Conducted by F. C. Fantz.

### Thursday, May 22

SOME EXPERIENCES IN WELDING HEAVY GAGE CHROMIUM-MOLYBDENUM STEEL FOR IMPACT APPLICATIONS—N. F. Ward, Associate Professor of Mechanical Engineering, University of California, Berkeley, Calif.

ARC WELDING OF CHROMIUM-MOLYBDENUM TUBING AND PLATES IN THE AIRCRAFT INDUSTRY—Charles J. Gallant, Engineer in Charge of Research and Processes, North American Aviation, Inc., Inglewood, Calif.

PRACTICAL ARC WELDING APPLICATIONS ON TUBULAR STRUCTURES IN AIRCRAFT—Francis N. Stevenson, Welding Supervisor, Vega Airplane Co., Burbank, Calif.

## American Foundrymen's Assoc.

(All sessions at the Biltmore Hotel)

### Thursday, May 22—9:30 a.m.

STEEL CASTINGS—C. H. Lorig, Battelle Memorial Institute, Columbus.

FOUNDRY CONTROL METHODS IN MAKING UNIFORM CAST IRON—E. K. Smith, Electro Metallurgical Co., Detroit.

### Friday, May 23—9:30 a.m.

STEEL CASTINGS—D. B. Reeder and L. N. Ludwig, Electro Metallurgical Co., New York.

HEAT TREATMENT OF CAST IRON—E. L. Bartholomew, Chief Engineer, United Shoe Machinery Corp., Beverly, Mass.

6:30 p.m.—Regional Dinner

NEW INFORMATION ON EFFECTS OF ALLOYS IN CAST IRON—V. A. Crosby, Climax Molybdenum Co., Detroit.

STEEL FOUNDRY MOLDING SANDS—C. W. Briggs, Technical Advisor, Steel Founders' Society, Cleveland.

MAGNESIUM CASTINGS—A. W. Winston, Dow Chemical Co., Bay City, Mich.

## Balke, Speaking on Refractory Metals, Reminisces on Development of Tantalum

Reported by Jack I. Medoff

Physical Metallurgist, Worthington Pump Co.

New York Chapter—Under the technical chairmanship of Gregory J. Comstock, Stevens Institute of Technology's indefatigable powdered metal enthusiast, the subject of "Powder Metallurgy" was capably presented by Claire C. Balke, Fansteel Metallurgical Corp., Chicago, on Feb. 10.

Introducing the speaker as "The brilliant son of a brilliant father", the chairman related how Mr. Balke had been lured to Stevens, made a professor and had stayed long enough to help organize the powder metallurgy department before returning to Fansteel.

The speaker chose to talk on the "refractory metals" and reminisced on his early acquaintance, through his father, with the metal tantalum.

Except for the early work of Wollaston on platinum, and of a few others, no commercial applications of powder metallurgy appeared until 1900 to 1910. The first was tungsten used for lamp filaments.

In 1920, the elder Balke did his well-known work on tantalum, and 14 months

later the first piece came out of the mill to become the second commercial application of powder metallurgy.

### Preparation of Powders

Tantalum and columbium powders are prepared by the electrolysis of the metal fluoride salts. In the formation of the compact from the powder, the following obstructions may be met:

1. Variation in particle size and shape.
2. Surface film on each particle (oxide, carbonate, etc.).
3. Surface gases and dissolved gases.
4. Lack of ductility caused by gases and dissolved impurities.
5. Mechanically held impurities.

The powder is subjected to 50 tons per sq.in. pressure, sintered, cold forged to close up porosity, and gets a second heat treatment during which recrystallization takes place. If the particles are very fine, they may form a solid mass the first time but if coarse, the compact may require a few workings.

The impurities in the powder may consist of 50 to 150 volumes of hydrogen, 0.05 to 0.20% carbon, magnesia as

added, 0.02% iron maximum and a little bit of remaining salt. Tantalum is so voracious that it takes oxygen from the most refractory metals, even calcium. However, by careful manipulation in the heating cycle, the various impurities can be eliminated.

Posing himself the question, "Why do compacts shrink?" the speaker offered a theory of his own crediting powerful forces acting along the surface—due more to surface tension than to recrystallization.

### Control of Porosity

For illustration, he cited the wrinkled surface of a globule of gold; if it is held for a few hours 200° below its melting point, a smooth surface will result though without melting.

Porosity or porous structure in refractory materials depends on the choice of particle size. If a porous structure is desired, i. e., little shrinkage, a large particle size should be used.

General practice is to have 30 to 60% controlled porosity, although 70% porosity has been produced experimentally.

An interesting review of the status of the synthetic rubber industry was presented by Dr. Brown of The Standard Oil Development Co., Bayway, N. J.

## Taylor, Former Stanford Teacher, Dies at Aberdeen

HOWARD S. TAYLOR, 47, of Owosso, Mich., died suddenly of a heart attack at Aberdeen, Md., on March 2. Captain Taylor, who had been a reserve officer in the Ordnance Department for 15 years, had arrived at Aberdeen only two days previously and been inducted into the service.

Taylor received his A.B. in chemical engineering from University of Michigan, served in the World War, and was then associated with Central Alloy Steel Co. He later became chief metallurgist for Caterpillar Tractor Co. in Stockton, Calif., and from 1927 to 1935 he was on the engineering staff of Stanford University.

During the last few years he had been in the insurance business in Owosso.

He is a past chairman and past secretary of the Golden Gate Chapter, A.S.M.

## Michigan Tech Has Party

Michigan College of Mining and Technology Group—February 21 was the date of the annual Washington Day get together. The party was held at the long famous Houghton Fire Hall, and was attended by 75 members, faculty, and guests.

## Doane Explains Principles of Magnaflux Test

Reported by M. M. Holtgrieve  
Hubbell and Company

St. Louis Chapter—Non-destructive testing of ferrous or magnetic material was the main topic of the March meeting, presented by F. B. Doane, vice-president of the Magnaflux Corp.

While Magnaflux inspection has its limitations, it is well adapted for locating cracks, grinding checks, weld flaws, quenching cracks and similar defects.

The principle of this method of testing is based on setting up a magnetic field across the defect to be located. When Magnaflux powder is applied, the defect will interfere with the magnetic field, causing a magnetic leakage, and this in turn attracts the Magnaflux powder which identifies the area in which the defect is located.

The Magnaflux powder has a very important part in the test, and, it has been found that the flat chip-shaped particle is more satisfactory than the spherical particle. These chips are coated so as to make them plainly seen and also to form a lubricant between one another.

The powder can be applied to the area being tested in either the dry form or in the paste form. The powder in paste form is mixed with a light oil of a very high flash point, which makes it safe to use around high temperatures, and also has a tendency to minimize fumes.

Mr. Doane pointed out that because of the extremely high sensitivity of this testing machinery, it must be used with a great deal of good judgment. The degree of sensitivity can be controlled in several ways, depending upon the type of defect which is to be located.

In closing this technical topic, Mr. Doane said some of the railroads who have applied this type of testing to their equipment have found that about 10% of their equipment they thought was in perfect condition was found to be cracked, but that 80% of these cracks were successfully ground out and the equipment thereby reclaimed.

## Factors Affecting Corrosion Expressed in Equation

Reported by Philip C. Rosenthal  
University of Wisconsin

Milwaukee Chapter—The "why's and wherefores" of galvanic corrosion were ably presented at the March meeting by F. L. La Que, Development and Research Division, International Nickel Co., New York.

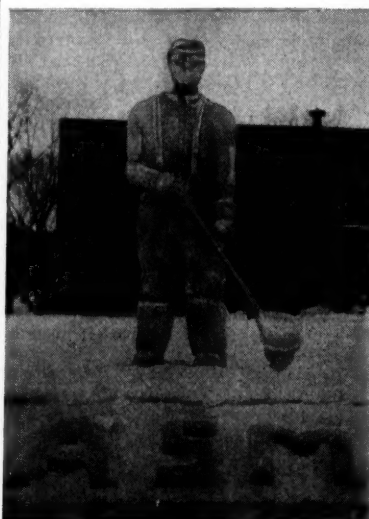
Mr. La Que explained how galvanic corrosion is influenced by such factors as potential, resistance, relative areas of the electrodes, polarization and over-voltage. The first four of these can be combined in an equation which links them to current, and consequently to the rate of corrosion.

Numerous illustrations were given to show how these principles could be applied to practice. An interesting example was given in the case of corrosion between iron and copper parts; painting the copper rather than the iron is the best way to minimize the corrosion.

Painting of the iron alone results in an unbalancing of the relative anode and cathode areas and promotes corrosion at pores or breaks in the paint coating.

The meeting was preceded by a colored motion picture "Steel for the Ages" prepared by Allegheny Ludlum Steel Corp.

## Campus Snow Man



"Hot Iron" Is the Name of the Snow Statue Erected by the Michigan College of Mining and Technology Group in Conjunction With the College Annual Winter Carnival. The statue was 15 ft. high. In the background may be seen the west wing, McNair Hall, Department of Metallurgical Engineering.

## Specific Examples Illustrate Technical Aspects of Powders

Reported by K. Siems

Sales Engineer, Cincinnati Milling Machine Co.

Cincinnati Chapter—A pioneer in the development of powder metallurgy, namely G. J. Comstock, associate professor of powder metallurgy at the Stevens Institute of Technology, was the speaker for the Feb. 13th meeting.

There is no doubt that Professor Comstock "lives" powder metallurgy. His detailed accounts of early experimentation, development, and the possibilities for increased use in the future made a most fascinating subject.

Numerous specific examples were cited, such as the oil pump gears now used by two of the largest automobile companies, one of which possesses a porosity of 18% and tensile strength of 18,000 psi.; an iron-copper-graphite door lock by another automotive concern eliminates all machining operations and is made permanently self-lubricating.

Equally interesting, of course, were the technical details submitted, as, for instance, that 8 oz. of powder will make three of one type of the pump gears referred to above; that very refractory strength metals can be handled in powder form; that a hot-pressed tungsten carbide powder makes the best wire drawing dies; and that the microscopic study of powders is a most important point.

He went on to say that the higher the pressure exerted when "molding" the product in the die, the less porous it will be. Moreover, articles of a density equal to that of bar or flat-rolled stock can be manufactured in this fashion.

## Photo-Elasticity Meeting

The thirteenth semi-annual meeting of the Eastern Photo-Elasticity Conference will be held on June 12, 13, and 14, 1941, at Cambridge, Mass., under the auspices of the Department of Mechanical Engineering at the Massachusetts Institute of Technology.

All inquiries should be addressed to W. M. Murray, Room 1-321, Massachusetts Institute of Technology, Cambridge, Mass.

## Informality Reigns in Hi Speed Discussion

Reported by Walter M. Saunders, Jr.  
Consulting Chemist and Metallurgist

Rhode Island Chapter—Interest in high speed steels has always been high in this district, and it was not surprising that an audience of about 150 turned out on March 5, to hear W. R. Frazer, chief metallurgist, Union Twist Drill Co., talk on "Metallurgical Control in the Manufacture of High Speed Tools".

Informality was the keynote of the evening, and Dr. Frazer's willingness to discuss the merits of various points raised by members during his talk resulted in a meeting of the symposium type. Interruptions were numerous, and, in turn, Dr. Frazer called on old friends for confirmation of some of his findings.

There were four main divisions of his talk: Inspection of high speed steel as it is received; supervision of the heat treatment; investigation of failures; and study of new developments.

Under inspection, Dr. Frazer showed by lantern slides the importance of avoiding carbide streaks, laminations and seams.

Possibly the outstanding remark about heat treatment was that a high carbon monoxide atmosphere is dangerous from the intense carburizing effect.

Failures may be caused by the customer's ruining a good tool by improper grinding, or by improper tempering. Dr. Frazer believes that no tool should go into the tempering furnace that has not cooled enough so it can be held in the hand.

From an extensive study of varying the amount of vanadium in the 18-4-1 type of high speed steel, Dr. Frazer is convinced that this element is of great importance, as regards effect on hardenability and grain size.

A. W. Meyer, Engineering and Patent Department, Brown & Sharpe Mfg. Co., was the coffee speaker, whose subject was "Fundamental Essentials to Obtaining Patents".

## Intricacies of Al Forging, Defense Problems Aired

Reported by J. M. Gotshall

Asst. Chief Chemist, Timken Steel & Tube Division

Canton-Massillon Chapter—In a talk given March 20 on "Aluminum Forgings for National Defense", L. W. Davis of the Aluminum Co. of America, Cleveland, brought out some of the intricacies of aluminum forging, the close control of temperatures necessary, care in design with reference to radii at the base and tip of webs, the ratio of height and thickness of webs to these radii, and the control of flow lines in the finished forging to obtain maximum strength.

Twenty-five per cent more power is required to forge aluminum than steel, and temperatures for forging, about 800° F., vary for the different alloys. Heat treating, quenching and aging of forgings to bring out the ultimate in strength and quality were also discussed.

Figures on production, which has steadily increased each year, were given and it was inferred that with the present knowledge of consumption and the foresight as to the increase of production in the near future, the aluminum shortage would probably clear up in late 1941.

The coffee talk "Growth and Development of Private Flying" by Atty. Frederick S. Wilkins, was particularly instructive and interesting in that aeroplanes other than commercial and military were considered.

## Need for Defense Is Today's Challenge to Engineer Editor Says

Reported by Francis T. McGuire

Teaching Fellow, University of Notre Dame

Notre Dame Chapter—A joint meeting was held on Feb. 12 with the Michigan Chapter, American Foundrymen's Association, the Manufacturers' Division, Association of Commerce of South Bend, and the South Bend Chapter No. 30, American Society of Tool Engineers. "Today's Challenge to the Engineer" was the subject of a talk by John H. Van Deventer, president and editor of *The Iron Age*.

In discussing the engineer's past, Mr. Van Deventer emphasized particularly his development of mass production methods which multiplied man's power of possession a thousand fold.

Today's challenge to the engineer is the challenge of Mars; the need for national defense. Mr. Van Deventer, in a recent survey trip through the United States, has been greatly impressed with the rapidity of the preparedness program.

While the program may not be moving fast enough for the imagination of the speed-loving American public, it is well to consider how difficult and tedious a job it is to organize the mass production of any single complicated product. Much preliminary groundwork is necessary with little to show for the great effort until close to the end, when out into the sunshine of completion comes the finished article.

Such a situation will probably be duplicated in this defense program. With a few exceptions, America is well supplied in practically all strategic materials.

Steel shortages and machine tool shortages can to a large extent be attributed to speculative buying caused perhaps innocently by panicky philosophy of large inventory prior to an anticipated great rise in price.

## Recent TECHNICAL BOOKS

### VISUAL EXAMINATION OF STEELS

by George M. Enos, University of Cincinnati

This book, written by an authority in the field of visual examination of metals, discusses macroscopic technique... macro-etching and other methods of testing. In a comprehensive and fundamental way the author first distinguishes between macroscopic and microscopic technique, then covers applications to steel and choice of lenses and equipment for their examination.

120 pages... 156 illustrations... 6 x 9... red cloth binding... \$2.00

### SURFACE TREATMENT OF METALS

Symposium and Discussions Presented at National Metal Congress.

An increasingly important phase of metal treating—Surface Treatment—was the subject of a symposium at the recent Metal Congress in Cleveland. Fifteen papers were presented by outstanding authorities—papers which drew hundreds of men to each of the three sessions.

400 pages... 140 illustrations... 6 x 9... red cloth binding... \$5.00

### METAL—INSIDE OUT

A lecture series presented before Philadelphia ASM chapter.

A not too technical description of the fundamentals of metallic structures. Discusses atoms... pure metal structures... rules governing alloying... equilibrium diagrams... hardness... microscopic studies... strength... and impurities.

112 pages... 85 illustrations... 6 x 9... cloth bound... \$2.00

### STRENGTH OF METALS

Under Combined Stresses

by Maxwell Gensamer, Carnegie Institute of Technology.

Delivered as an Educational Course in the 1940 Metal Congress at Cleveland. Principles that may be used as guides in predicting the resistance to deformation and relative ductility of metals under complex conditions are explained.

125 pages... 96 illustrations... 6 x 9... cloth bound... \$2.00

American Society for Metals  
7301 Euclid Ave. Cleveland, O.



## EXHIBITORS' LIST

Western Metal Show  
Los Angeles, May 19-23

Air Reduction Sales Co., New York  
Allen Bradley Co., Los Angeles  
Allen Manufacturing Co., Hartford, Conn.  
Allis-Chalmers Manufacturing Co., Milwaukee  
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American Machine & Metals, Inc., E. Moline, Ill.  
Ampco Metal, Inc., Milwaukee  
Applied Research Labs., Los Angeles  
Armstrong-Blum Co., Chicago  
Askania Controls, Chicago

Bakewell Mfg. Co., Los Angeles  
Baldwin Southwark Div.  
Baldwin Locomotive Works, Philadelphia  
Bastian-Blessing Co., Chicago  
Bausch & Lomb Co., Rochester, N. Y.  
Bergstrom Steel Co., Los Angeles  
Bethlehem Steel Co., Bethlehem, Pa.  
Blakeslee & Co., G. S., Cicero, Ill.  
Braun Corp., Los Angeles  
Bristol Co., Waterbury, Conn.  
Brown & Sharpe, Providence, R. I.  
Brown Instrument Co., Philadelphia  
Buehler, A. I., Chicago

Carbonyl Co., Inc., Detroit  
Carnegie-Illinois Steel Corp., Pittsburgh  
Chamberlain Co., Los Angeles  
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Coffing Holst Co., Danville, Ill.  
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## Here and There With A.S.M. Members

THE DEPARTMENT of Metallurgical Engineering at Carnegie Institute of Technology has in recent years been developing its faculty and research program on the physical chemistry of steel making, headed by GERHARD DERGE.

ALLAN E. MARTIN, recently of the University of Minnesota, has joined this group, and it is now announced that KARL FETTERS, B.S. Carnegie Tech 1931 and D.Sc. Massachusetts Institute of Technology 1940, will be added at the beginning of the next academic year.

\* \* \*

AFTER 20 years' service in the Equipment and Materials Section of the Bureau of Aeronautics, Navy Department, 11 of which were in metallurgical and research duties at the Naval Aircraft Factory, HARRY J. HEUSTER is now connected with the Reynolds Metals Co.

His headquarters will be in Washington, D. C., and he will have personal contact with the various aluminum alloy plants of the company.

\* \* \*

PEORIA Chapter has lost C. H. LAGE, one of the Executive Committee members, who has accepted a position with the Davis Thompson Machine Co. of Milwaukee.

Mr. Lage, while in the employ of the Caterpillar Tractor Co., was superintendent of the Mechanical Division of the Tractor Planning Department.

\* \* \*

SECRETARY-TREASURER A. J. CARRUTHERS of the Springfield Chapter, A.S.M., has moved to Greenfield, Mass., to take up new duties with the Greenfield Tap & Die Corp. He was formerly with Westinghouse Electric & Mfg. Co. in Springfield.

Monarch Steel Co., Indianapolis  
Moore Machinery Co., Los Angeles

National Cylinder Gas Co., Chicago  
National Engineering Co., Chicago  
National Tube Co., Pittsburgh  
Natural Gas Bureau, Los Angeles  
Natural Gas Equipment Co., Inc., Los Angeles  
Norton Co., Worcester, Mass.

Oakite Products, Inc., New York  
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Olsen Testing Machine Co., Philadelphia

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Pacific Gear & Tool Works, Los Angeles  
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Paramount Mfg. Co., Los Angeles  
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Partlow Corp., New Hartford, N. Y.  
Payne Furnace & Supply Co., Beverly Hills, Calif.

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Reeves Pulley Co., Columbus, Ind.  
Reliance Regulator Co., Alhambra, Calif.  
Republic Steel Corp., Cleveland  
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Skilzaw, Inc., Los Angeles  
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Spencer Turbine Co., Hartford, Conn.  
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Yale & Towne Manufacturing Co., Los Angeles

## Horger's Talk Added Treat at President Night

Reported by W. G. Patton  
Engineer, Climax Molybdenum Co.

Detroit Chapter—National President's Night was celebrated on March 10 with messages by A.S.M. President Oscar E. Harder and Past-President William P. Woodside. An additional treat was a talk by O. J. Horger, Timken Roller Bearing Co., on "Fatigue of Metals with Related Photo-Elastic Studies".

In his address, Dr. Horger reviewed his experiences while visiting A. S. M. chapters throughout the country and congratulated the Detroit officers and members on their present roster of 992 paid-up members, largest of any A.S.M. Chapter.

Dr. Horger's address was outstanding in its timeliness, organization and illustrations. His work in the fatigue field is so far advanced that most of the results of his researches are "news" to even the best informed metallurgists.

### Plastic Models Used

The manner in which design, shape, metallurgical and material conditions may be varied to obtain greater fatigue strength was presented in considerable detail. In determining shapes that will best distribute applied stresses, Dr. Horger makes use of plastics to which stresses are applied to simulate actual service loading. When photographed under polarized light, the stress concentrations are strikingly revealed as "fringes".

In addition to simple shapes, the speaker illustrated with lantern slides the fringe patterns that are characteristic of holes and fillets. He pointed out that as a result of such studies, railroad axles had been re-designed and improved in fatigue strength 60 to 80% while increasing weight only 4%.

Among other things, Dr. Horger warned his listeners against blindly accepting results of fatigue tests on small R. R. Moore type specimens as being necessarily indicative of the endurance limit of the same material in large members.

As a means of improving fatigue strength, the speaker pointed out the merits of flame hardening, burnishing and metal spraying the pressed-fit portions of locomotive parts.

### Movies Show Wheel Action

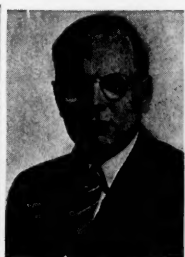
Among the outstanding features of Dr. Horger's address were the high speed movies showing the dynamic action between driving wheels of steam locomotives and the rail as influenced by the weight of reciprocating parts (piston, piston rod, crosshead, etc.).

With the wheels rotating at a rate of 108 miles per hr., the pictures show that the main driving wheel clearly leaves the rail as much as 3/8 in. at frequent intervals, resulting in severe track hammer that may produce "kinks" in the rails. The improved design of reciprocating parts weighing only 1000 lb. as compared to 2000 lb. for the conventional application clearly reduces this poundage and permits higher speeds without track damage.

The following nominating committee was elected at the March meeting: W. E. Jominy, chairman, E. G. Brick, F. P. Zimmerli, A. C. Dames, E. B. Drake.

were revealed, involving the question of multi-axial stresses. The behavior of double width test pieces was particularly interesting.

It could be concluded that the term "impact resistance" is incorrectly used to include the two factors of notch sensitivity and velocity effect.



Roger Sutton



Hal Chase

NEW ADDITIONS to the staff of General Alloys Co., Boston, include ROGER SUTTON, who has been made director of engineering and metallurgy. He comes from Chrysler Corp., Detroit, where he has been a metallurgist for the past eight years. He has also been for the past five years instructor in chemistry and metallurgy at the Chrysler Institute of Engineering.

Mr. Sutton has a M.S. degree from University of Detroit (1928), and has worked for Timken-Detroit Axle Co., Gemmer Mfg. Co., Forging and Casting Corp., and Halcomb Steel Co.

HAL G. CHASE, assistant to the president of General Alloys Co. (who boasts that he has attended every National Metal Exposition since 1920), is coming into the Boston office from his western territory to help out with the defense program. He will continue to handle his territory by frequent jumps out of the Boston office.

Other appointments include L. M. LINDSEY as engineering sales manager, formerly with Surface Combustion Corp., and ROGER D. CARVER as superintendent (coming from Ross-Meehan Foundries, Chattanooga, Tenn., where he was superintendent of the steel foundries).

## Inclusions Abused As Cause of Fatigue Failure Hoyt Agrees

Reported by Robert D. Stout

Dept. of Metallurgy, Lehigh University

Lehigh Valley Chapter—Stating that the title of his address implied two distinct and separate subjects, which he would consider singly, Samuel L. Hoyt of Battelle Memorial Institute gave a talk on "Impact and Fatigue" on Mar. 7.

Discussing fatigue, Dr. Hoyt pointed out the factors which control the endurance limit of a steel part, illustrating his remarks with slides showing examples of the effect of each factor. He referred freely to Dr. Gillette's forthcoming book on the subject.

In the discussion, M. W. Dalrymple appealed to the speaker to confirm him in his belief that inclusions are much abused as nuclei for fatigue failure, inasmuch as there is a strong tendency to place the blame glibly on them even when close examination reveals that they are considerably displaced from the starting point of fatigue failure.

Dr. Hoyt agreed that inclusions should not be considered the cause unless the evidence was clearly at hand to justify it.

On the subject of impact, Dr. Hoyt issued a challenge to the audience to explain what was meant by "impact resistance", but no one present seemed to feel sure he knew.

He then discussed at length the characteristics of notch sensitivity (which is the property that most of the "impact" tests measure), and gave what he cautioned was a rather oversimplified exposition of the notch effect, and the procedure to be followed in testing for it.

In the discussion, further details

## Hardness Test For Abrasives Is Described

Reported by R. E. Christin

Metallurgist, Columbus Bolt Works Co.

Columbus Chapter—At a joint meeting in March with the local chapter of the American Society of Tool Engineers, A.S.M. Chairman C. H. Lorig introduced Roy J. Freter, chairman of the A.S.T.E., and S. J. Matchett, secretary.

Over 100 members and guests of both chapters heard Lowell H. Milligan, assistant director of research, Norton Co., Worcester, Mass., deliver a lecture on "Abrasives and Grinding Wheels".

The speaker clearly explained the fundamental properties of abrasive materials, and discussed the new indentation hardness method of measurement developed at the U. S. Bureau of Standards. This employs a diamond-shaped diamond indenter, and is peculiarly adapted for measuring the hardness of abrasives because they can be indented without causing chipping or cracking.

### Tensile Strength Also Important

However, it was pointed out that since failure of the brittle abrasives in use occurs from tension and not compression, it is necessary also to consider the tensile strength characteristics of abrasive materials, if any thorough understanding of the mechanism of abrasive action is attempted.

An abrasive-impact test was described in which a definite volume of sand or other abrasive grain is blown down with constant air pressure upon the specimen being tested, and the depth of the hole produced is measured.

The various bonding materials employed for making grinding wheels include vitrified bond glasses and organic bonds such as hard rubber, resinoids.

Slides were shown to illustrate various types of commercial abrasive operations, such as snagging, precision grinding of automotive and aircraft parts, and wet cutting-off operations.

### Sandblast Tests Described

During the discussion Dr. H. W. Russell, physicist at Battelle Memorial Institute, told about some experiments he had made with a sandblast method to determine the probable resistance that different metals would have toward abrasive wear in practice. All the metals behaved about alike in the test, even though they were known to exhibit marked differences in practice.

Dr. Milligan explained that the conditions obtained by penetrating with the sandblast are quite different from those prevailing in practical wear, and probably all of the steels were soft enough to be penetrated readily.

It was also brought out in the discussion that the smoothness of finish produced on the material being ground with a grinding wheel is tremendously influenced by the character of the preliminary truing operation on the wheel.

A colored movie on the manufacture of grinding wheels concluded this very informative lecture.

## Jackman & Gadgets



K. R. Jackman of Consolidated Aircraft Demonstrates Strain Gages

## Stress Analysis Applied To Aircraft Materials

Reported by R. Lowry

Metallurgist, Hydri Co.

Los Angeles Chapter—An unusual paper entitled "Cold Working Aircraft Materials" delivered by Mr. K. R. Jackman, chief structural test engineer, Consolidated Aircraft Corp., San Diego, is slated for publication in an early issue of METAL PROGRESS, so only brief mention need be made of it here.

This paper presents practically the whole field of analysis of stresses as measured by strain gages, including very new types of strain gages and their uses. Mr. Jackman brought along a number of his "gadgets", as he called them, which were inspected with great interest.

This work, representing much time, thought and effort, will no doubt be a very welcome source of reference for many engaged in similar testing.

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## CHAPTER CALENDAR

| CHAPTER       | DATE    | PLACE                                    | SPEAKER           | SUBJECT  |
|---------------|---------|--|-------------------|--|
| Baltimore     | May 19  | Engineers Club                           |                   | Annual Meeting   |
| Boston        | May 2   | M.I.T. (Annual Meeting)                  | V. T. Malcolm     | Surface Hardening of Stainless Steel   |
| Buffalo       | May 8   | Hotel Buffalo                            |                   | Annual Meeting   |
| Calumet       | May 20  | Woodmar Country Club, Hammond, Ind.      | Thos. J. Dolan    | Engineering Analysis with Polarized Light  |
| Calumet       | June 14 | Woodmar Country Club, Hammond, Ind.      |                   | Golf Stag  |
| Canton-Mass.  | June 20 | Elks Club, Canton                        |                   | Summer Party   |
| Chicago       | May 8   | Towers Club                              | R. S. Archer      | Problems Ahead for Metallurgy  |
| Cincinnati    | May 9   | Kenwood Country Club                     |                   | Annual Outing  |
| Cleveland     | May 5   | Cleveland Club                           | C. C. Nitchie     | Spectroscopy in the Metal Industries   |
| Dayton        | May 14  | Engineers Club                           |                   | Installation of Officers; Plant Visit  |
| Detroit       | May 12  | Webster Hall                             | S. L. Hoyt        |  |
| Detroit       | June    |  |                   | Annual Outing  |
| Hartford      | May 13  | New Britain, Conn.                       | R. M. Burns       | Recent Developments in Protective Metallic Coatings  |
| Hartford      | June 10 |  |                   | Annual Outing  |
| Indianapolis  | May 19  | Washington Hotel                         |                   | Round Table Discussion; Annual Meeting   |
| Lehigh Valley | May 3   | Hotel Traylor, Allentown, Pa.            |                   | Annual Dinner Dance  |
| Milwaukee     | May 16  | Crane Co., Chicago                       |                   | Plant Visitation   |
| Milwaukee     | May 20  | Athletic Club                            | A. H. Wilson, Jr. | Platinum—a Precious Metal  |
| Montreal      | Apr. 28 | Windsor Hotel                            | W. Paul Eddy, Jr. | Automotive Service Failures  |
| New Haven     | May 15  | Hammond Laboratory, Yale University      | Bradley Stoughton | Metallurgy and Its Place in Industry   |
| New Haven     | June 7  | Pine Orchard Country Club                |                   | Annual Outing  |
| New Jersey    | May 19  | Essex House, Newark                      | B. Clements       | Aircraft Engine Materials  |
| New York      | May 12  | Bldg. Trade Employers Assoc. Clubroom    | E. V. Crane       | Dies & Deep Drawing Operations   |
| North West    | May 14  |  |                   | Annual Meeting   |
| Notre Dame    | May 14  | Engineering Audit, Univ. of Notre Dame   | H. B. Osborn, Jr. | Induction Hardening  |
| Ontario       | May 2   | Hamilton, Ont.                           | R. C. Stewart     | Trouble Shooting   |
| Ontario       | May 16  | St. Catharines                           | O. W. Ellis       | Forging  |
| Ontario       | June 13 |  |                   | 13th Annual Field Day  |
| Peoria        | May 12  |  | G. J. Comstock    | Industrial Application of Powder Metallurgy  |
| Philadelphia  | May 16  | Univ. of Penna.                          |                   | Conference on Hardness   |
| Philadelphia  | June 6  |  |                   | Annual Meeting and Outing  |
| Pittsburgh    | May 8   | Roosevelt Hotel                          | E. S. Davenport   | Heat Treatment of Carbon and Alloy Steels from the Viewpoint of Isothermal Transformations |
| Rhode Island  | May     | Providence, R. I.                        |                   | New England Sectional Meeting  |
| Rochester     | May 12  | Univ. of Rochester                       |                   | Annual Meeting   |
| Rockford      | May 28  | Elks Club                                | O. B. Wilson      | Fundamentals of Automatic Temperature Control  |
| Rocky Mtn.    | May 16  | Oxford Hotel                             |                   | Election of Officers   |
| Saginaw Val.  | May 20  | Midland Country Club                     | J. D. Zaiser      | Modern Bronze Alloys   |
| Schenectady   | May 6   |  |                   | Information Please   |
| Southern Tier | May 26  | Jenkins Inn, Waverly, N. Y.              | E. W. P. Smith    | Welding & Welding Design   |
| Springfield   | May 19  | Hotel Sheraton                           |                   | Annual Meeting   |
| St. Louis     | May 16  | York Hotel                               | A. J. Scheld, Jr. | Manufacture of Tool Steel  |
| Texas         | May 15  |  | O. E. Harder      | Bearing Metals   |
| Toledo Group  | May 26  | Hillcrest Hotel                          |                   | Cast Iron  |
| Tri-City      | May 13  | Hotel Ft. Armstrong, Rock Island, Ill.   | Howard Stagg      | Tool Steels  |
| Worcester     | May 7   | Sanford Riley Hall, Wor. Polytech. Inst. | L. H. Milligan    | Surface Finish of Metals   |
| York          | May 16  | York Country Club                        |                   | Annual Meeting   |

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